

**WHAT IS CLAIMED IS:**

1. A method for controlling a solenoid valve of an automatic transmission of a vehicle, the method comprising:

calculating a base over-excitation period of the solenoid valve;

calculating a target duty of the solenoid valve;

determining if the target duty lies in a predetermined duty range;

calculating an over-excitation period adjusting value of the solenoid valve when the target duty lies in the predetermined duty range;

calculating a target over-excitation period of the solenoid valve on the basis of the over-excitation period adjusting value and the base over-excitation period; and

realizing the target over-excitation period of the solenoid valve of the solenoid valve.

2. The method of claim 1, wherein the predetermined duty range comprises a duty range within which the solenoid valve operates non-linearly with respect to an applied duty.

3. The method of claim 1, wherein the predetermined duty range lies within a range of less than 50%.

4. The method of claim 3, wherein the predetermined duty range comprises a range of 0-30%.

5. The method of claim 1, further comprising starting operation of the solenoid valve according to the target duty,

wherein the calculating the over-excitation period adjusting value is executed after the starting the operation of the solenoid valve according to the target duty, and

the target over-excitation period is calculated as a subtraction of the over-excitation period adjusting value from the base over-excitation period.

6. The method of claim 5, wherein the predetermined duty range comprises a duty range within which the solenoid valve operates non-linearly with

respect to an applied duty.

7. The method of claim 5, wherein the predetermined duty range lies within a range of less than 50%.

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8. The method of claim 7, wherein the predetermined duty range comprises a range of 0-30%.

9. The method of claim 1, further comprising:  
10 determining if an ATF temperature satisfies a predetermined temperature condition; and  
determining if an applied voltage of the solenoid valve satisfies a predetermined voltage condition,  
wherein the calculating the over-excitation period adjusting value is executed  
15 only when the ATF temperature satisfies the predetermined temperature condition and the applied voltage of the solenoid satisfies the predetermined voltage condition.

10. An apparatus for controlling a solenoid valve of an automatic transmission of a vehicle, comprising:  
20 a throttle opening detector for detecting a throttle valve opening of the vehicle;  
a vehicle speed detector for detecting a speed of the vehicle;  
a fluid temperature detector for detecting an automatic transmission fluid (ATF) temperature of the automatic transmission;  
a voltage detector for detecting an applied voltage of the solenoid valve;  
25 a shift lever position detector for detecting a shift lever position of the automatic transmission; and  
a transmission control unit (TCU) for controlling the solenoid valve on the basis of signals from the detectors,  
wherein the TCU executes a set of instructions for a method comprising:  
30 calculating a base over-excitation period of the solenoid valve;  
calculating a target duty of the solenoid valve;  
determining if the target duty lies in a predetermined duty range;

calculating an over-excitation period adjusting value of the solenoid valve when the target duty lies in the predetermined duty range;

calculating a target over-excitation period of the solenoid valve on the basis of the over-excitation period adjusting value and the base over-excitation period; and

5 realizing the target over-excitation period of the solenoid valve of the solenoid valve.

11. The apparatus of claim 10, wherein the predetermined duty range comprises a duty range within which the solenoid valve operates non-linearly with  
10 respect to an applied duty.

12. The apparatus of claim 10, wherein the predetermined duty range lies within a range of less than 50%.

13. The apparatus of claim 12, wherein the predetermined duty range  
15 comprises a range of 0-30%.

14. The apparatus of claim 10, further comprising starting operation of the solenoid valve according to the target duty,

20 wherein the calculating the over-excitation period adjusting value is executed after starting the operation of the solenoid valve according to the target duty, and

the target over-excitation period is calculated as a subtraction of the over-excitation period adjusting value from the base over-excitation period.

25 15. The apparatus of claim 14, wherein the predetermined duty range comprises a duty range within which the solenoid valve operates non-linearly with respect to an applied duty.

30 16. The apparatus of claim 14, wherein the predetermined duty range lies within a range of less than 50%.

17. The apparatus of claim 16, wherein the predetermined duty range

comprises a range of 0-30%.

18. The apparatus of claim 10, wherein the TCU further executes instructions for:

5 determining if an ATF temperature satisfies a predetermined temperature condition; and

determining if an applied voltage of the solenoid valve satisfies a predetermined voltage condition,

10 wherein the calculating the over-excitation period adjusting value is executed only when the ATF temperature satisfies the predetermined temperature condition and the applied voltage of the solenoid satisfies the predetermined voltage condition.